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| **Subcutaneous Fungal Infections**   * **Confined to dermis, subQ, or adj. structures---no systemic spread** * **Slow onset and chronic duration** * Primary confined to tropical regions (Americas-rare in US, S. Africa, Australia * Infection starts with trauma inoculation from soil or plants | | | | |
| **Name** | **Diagnosis/Labs** | **Symptoms/Clinical Features** | **Pathogenesis** | **Treatment** |
| **Eumycotic Mycetoma** | Causative Agents   * Saprophytic fungi (eumycetoma) * Actinomyces (bacteria) * \*\*SO MANY!   “Madura foot”   * Granules of mycelium * Can also see filamentous bacteria (actinomycetes) but distinguish based on the width of the filaments | * Post-traumatic chronic infection * Sites—feet, lower extremities, hands * Findings—abscess formation, draning sinuses containing granules * Can involve muscle and bone locally * Pus filled sinuses in foot * See “black grain” | **Common in tropical climates with low rainfall** | Surgery   * Excision, possible amputation * Ampho B * Azoles |
| ***SubQ Zygomycosis (another zygomycosis is in opportunistics)*** | * *Basidiobolus & Conidiobolus spp.* * Biopsy for dx | * Large swelling areas | * Saprophytes—leaf and plant debris * Implanted through skin * Large painless masses | * Itraconazole * KI |
| **Chromomycosis**  **--*Fonsecaea, Phialophora,***  ***Cladosporium***  http://www.moldinspector.com/images/exophi15.jpg | **Chromoblastomycosis**: Round, **sclerotic bodies**  Naturally brown in KOH mount  Screen Shot 2012-10-21 at 10  \*\*COLORFUL GRANULES  -pigmented (dematiaceous) fungi in soil and woody plants (decaying material)  -Dimorphic | * Vurrucoid, ulcerated and crusted * Flat or raised * Satellite lesions by autoinoculation or lymphatics * Extensive keloid (scar) formation * Chronic lesions—cauliflower like * Chronic infection of melanized cells |  | * Surgery—excision * Antifungal therapy—itraconazole, terbinafine |
| ***SubQ Phaeohyphomycosis***  ***“Black mold”*** | * **Biopsy, culture**   **Phaeohyphomycosis**: Hyphae  Naturally brown in KOH mount | * **Slow growing, painless cysts** | * Seen in soil, vegetation | * Surgical excision |
| **Sporotrichosis**  Is also a true pathogen      Screen Shot 2012-10-21 at 10 | * *Sporothrix schenckii*   + Natural habitat: soil   + “Rose-thorn/Rose-gardner Disease”   + Dimorphic (determined by temperature)     - 37C = **cigar-shaped yeast**     - 25C = septate hyphae, oval conidia (mold)   Lab   * fluid aspirate, pus, tissue biopsy * culture: mold 🡪 yeast * serology—exoantigen test * intradermal test—sporotichin * Conidia/conidiophores at 25C culture  |  |  | | --- | --- | | **25C** (*in vitro*) | **37C** (*in vivo*) | | Image55 | Image56  Macintosh HD:Users:elisafuray:Desktop:Screen Shot 2012-11-07 at 2.38.30 AM.png | | Conidia | Cigar-shaped yeast | | * SubQ   + Follows minor frauma 🡪 nodule 🡪ulcer 🡪necrosis of skin/subQ tissue 🡪lymphatic channels 🡪 lymph nodes * Extra cutaneous   + Very rare—bones, joints, meninges, lungs * See cutaneous lesions usually at the site of inoculation/lymphatics * Epidemics in Gold mines (via wood structure) and forestry workers (inoculated via pine needles) | Lymphocutaneous   * Skin trauma, often via thorns, splinters * **Neutrophil** immunity important   Systemic (Rare, immunosuppress’d)   * Inhaled, spread to joints, bones, brain * Strains with higher temperature threshold spread better   Chronic (Rare, immunosuppress’d) | Excise the lesion if possible  SubQ   * Itraconazole * Saturated KI orally   Extracutaneous   * Amphotericin B (IV) * Itaconazole   **\*\*these infections take a while to heal** |
| **Eumycotic Mycetoma** | * Tissue biopsy * Demonstration of **granules** * Characteristics of the granule & colony morphology are used for identification   **Causative Agents**   * *Madurella mycetomatis* * *Phaeoacremonium spp.* * *Exophiala jeanselmei* * *Aspergillus nidulans* * *Fusarium spp.* * *Scedosporium spp.* * *Actinomyces* | * Post-traumatic chronic inf   Site(s):   * Feet, lower extremities, hands   Findings:   * Abscess formation, * Draining sinuses containing **granules** * Can involve muscle & bone locally | * Common in tropical climates w/ low rainfall | Surgery   * Excision * Possible amputation   Antifungal therapy   * Amphotericin B * Azoles |

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|  | | **True Pathogenic Fungal Infections – ALL ARE DIMORPHIC** | | |  |
| **Name** | **Diagnosis/Labs** | | **Symptoms** | **Region** | **Treatment** |
| ***Histoplasma capsulatum***  “Darling’s Diseases” | |  |  | | --- | --- | | Saprobic phase | Parasitic phase | | **Tuberculate hyphae**  hcap1  **http://www.doctorfungus.org/imageban/images/init_images/068MIKE.JPG** | Budding yeast  buddingYeastCells  http://www.doctorfungus.org/imageban/images/Kaminski005/415.jpg |  * Tuberculate Macroconidia and microconidia Micro are worse because they get deeper in lung * Tissue form—small intracellular yeasts with narrow neck on bud * No capsule * Mold look like **cotton** * **\*\*Narrow-based intracellular budding yeast in RES**   Labs   * Serology—complement fixation & immunodiff * Ag’s, but some react with *Coccoides* Ag’s (West) * Urine and/or serum Ag testing (92% sensitive in in severe disseminated infection) * Biopsy for histopathology and culture | | * Inhaled microconidia 🡪 convert to **budding yeast🡪 taken up by alveolar macrophages \*\*intraphagocytic** * can also get primary cutaneous inoculation * TB-like lesions in lungs : calcifi’d * Dissemination & growth restricted to **reticuloendothelial** system by blood * http://pathmicro.med.sc.edu/mycology/histo1.jpg Suppression of cell mediated immunity * 10-14 days before immune system controls BUT, inflammatory symptoms not seen for 2 wk * **Infection should confer immunity** But massive subsequent inoculation could cause symptomatic inflammation * **Clinical Features**   + **Pulmonary—**95% asx, mild, moderate, severe, chronic cavitary   + **Disseminated—**RES (liver, spleen, **lymph nodes,** bone marrow), mucocutaenous infection * Dissem. And fatal course are more common in immunocompromised, children <2 and elderly | * Seen in **Midwest and South** * Latin America, Asia, Europe, Afric * Grows in soil and other things contaminated with **Bat/Bird guano**. | * **NONE REQUIRED FOR ASX CASES** * **Itraconazole for local** * **Amphotericin B for disseminated or secondary** * Only really needed in immunocomp. * **Fluconazole** for CNS dz because it has good CNS penetration * **Surgical** resection of pulmonary lesions |
| ***Histoplasma duboisii***  ***“African Histoplasmosis”*** | * Larger, thicker walled yeast cells * Pronounced **giant cell formation** in infected tissue (not granulomas like the other histoplasma) | | * Greater frequency of **skin and bone lesions** |  | * **Same as above for other histo spp.** |
| ***Coccidoides immitis***  California Valley Fever | |  |  | | --- | --- | | Saprobic phase | Parasitic phase | | **Arthroconidia** (Thallic)  Arthroconidia_of_Coccidioides_immitis_39G0040_lores | **Spherules w/endo’s (Not a yeast)** Cover FigureMacintosh HD:Users:elisafuray:Desktop:Screen Shot 2012-11-07 at 2.33.03 AM.png |  * **At 25 C see barrel shaped arthroconidia** * **Immunodiff & latex agglut. , and complement fixation** * Infection should confer immunity * Worse in males * **Pregnant women more susceptible as pregnancy progresses 🡪 Spherules grow faster w/Estradiol**   **Serology**   * Compl. Fixation—dx & prognosis * Immunodiff & latex agglut🡪 detects 93% | | * Inhaled arthroconidia 🡪 *thick*-walled **spherules with endospores** disseminate (only endospores are vulnerable) * **Primary** infection (mostly in lung)—seen in immunocomp. Or if they got a low dose of the bug   + Asx in most, fever, chest pain, cough, weight loss * **Secondary** infection (>6 weeks—5%)—seen in heavy dose of bug or immuncocomp.   + Nodular and cavitary or progressive lesions in lungs * **Disseminated** infection (1%)—chronic/fulminant   + Infection may result in chronic pulmonary condition and/or dissem to Meninges (**25%),** bones, joints, soft tissue, subQ or cutaneous tissues * Goes to many sites, including **skin** & **CNS** * CNS infections are lifelong if immunosuppress’d * Infection from aerosolized dirt * **The most virulent fungal pathogen** | * **Desert soil** in SW USA (CALIFORNIA), N. Mexico, region of Central/South America * **^^DRY CLIMATES (commonly carried in dust storms)** | * Symptomatic treatment only (primary infection) * Amphotericin B * Itraconazole * Fluconazole (particularly for meningitis due to good penetration into CNS) |
| ***Blastomyces dermatidis***  North American Blastomycosis | |  |  | | --- | --- | | Saprobic phase | Parasitic phase | | **Conidophore**  Image4**http://www.doctorfungus.org/imageban/images/init_images/202MIKE.JPG** | Budding yeast  167MIKE.jpg                                                    000022DFHOME                           ABA78158: |  * Often see a **broad based yeast** * Samples-sputum, tissue * Culture—Mold at 25C and conversion to yeast on enriched media at 37C * Serology—to detect Ab🡪 immunodiffusion test, complement fixation, ELISA * Urine and/or Serum Ag testing * Skin test for Ag | | * Inhaled spores (microconidia)🡪 yeast disseminate🡪 infiltration of macrophages and PMN🡪 granuloma formation * Oxidative killing mechanisms of PMN and fungicidal activity of macrophages control infection * Can also get primary cutaneous inoculation * 50% are asx * Onset: acute or chronic-- Chronic, will kill if not treated * Pulmonary disease may be severe or very mild * Extrapul dz🡪Disseminated to ***skin*, bone, prostate, liver, spleen, kidney & CNS** * Can sometimes find yeast in prostatic secretions * In soil and organic debris (decaying) | * **Ohio-Mississippi river valley** * **Africa** | * **Amphotericin B** * **Itraconazole** * **Fluconazole** * **Surgery** |
| ***Paracoccoides brasiliensis***  South American Blastomycosis | |  |  | | --- | --- | | Saprobic phase | Parasitic phase | | Conidia Hifa de Paracoccidioides brasiliensis | **Multipolar budding yeast attached to parent cell by a narrow base**  **Screen Shot 2012-10-21 at 9** | | | * Inhalation of conidia 🡪 **Multipolar yeast** disseminate * Asx infection * Latent form * Sx infection—nodular lesions in lungs, dissemination to other organs (rare) * Chronic single or multiple organ involvement * Lungs, mouth, nose, lymph nodes | * **Central/South America--BRAZIL** | * Itraconazole * Amphotericin B * Fluconazole * Sulfonamides |
| ***Penicilliosis marneffei*** | * Recovered from bronchioalveolar lavage (BAL), blood, tissue, and biopsy specimen | | * Pulmonary or dissem. Dz | * **SE Asia (esp HIV infected)** | * Ampho B * Itraconazole |